Econ330 – Money and Banking
Solutions to Problem Set 3

Question 1

The initial balance sheet is

Assets		Liabilities	
Reserves	20	Checkable deposits	150
Loans	110	Discount loans	20
Securities	50	Bank capital	10
Total	180	Total	180

(i) There are actually two transactions that occur: first, the deposit is withdrawn (which lowers the checking deposits on the liabilities side) and the money is paid from reserves:

Assets		Liabilities	
Reserves	**10**	Checkable deposits	**140**
Loans	110	Discount loans	20
Securities	50	Bank capital	10
Total	**170**	Total	**170**

Now, the required reserves are $RR = 10\% \cdot 140 = \$14$ million, so the bank needs to find $4 more million to cover for the required reserves, by taking a discount loan:

Assets		Liabilities	
Reserves	**14**	Checkable deposits	140
Loans	110	Discount loans	**24**
Securities	50	Bank capital	10
Total	**174**	Total	**174**

(ii) The balance sheet after the bank sells securities to pay back the $4 million it had borrowed is:

Assets		Liabilities	
Reserves	14	Checkable deposits	140
Loans	110	Discount loans	**20**
Securities	**46**	Bank capital	10
Total	**170**	Total	**170**

(iii) The new deposit affects the "checkable deposits" and "reserves" items in the balance sheet:

Assets		Liabilities	
Reserves	**19**	Checkable deposits	**145**
Loans	110	Discount loans	20
Securities	46	Bank capital	10
Total	**175**	Total	**175**

(iv) Given the new sum in checkable accounts, the required reserves are now $RR = 10\% \cdot 145 = \$14.5$ million. The bank has now $19 - 14.5 = \$4.5$ million available (as excess reserves) for new loans. If it gives all of them out, the balance sheet becomes:

Assets		Liabilities	
Reserves	**14.5**	Checkable deposits	145
Loans	**114.5**	Discount loans	20
Securities	46	Bank capital	10
Total	175	Total	175

Question 2

To calculate the gap and the impact on bank profits, we will use the formulas:

$$\Delta Profits = \Delta i \cdot GAP,$$
$$GAP = \textit{rate-sensitive assets} - \textit{rate-sensitive liabilities} = \textit{loans} - \textit{deposits},$$

since, in our example, the rate-sensitive assets are only the loans, while the rate-sensitive liabilities are only the checkable deposits. The change in the interest rate is always $\Delta i = 10\% - 5\% = 5\%$, so we only need to calculate the gap:

(i) $GAP = 110 - 140 = -\$30$ million $\Rightarrow \Delta Profits = -30 \cdot 5\% = -\$1.5$ million.

(ii) since neither loans nor deposits change, $\Delta Profits = -30 \cdot 5\% = -\$1.5$ million.

(iii) $GAP = 110 - 145 = -\$35$ million $\Rightarrow$ $\Delta Profits = -35 \cdot 5\% = -\$1.75$ million.

(iv) $GAP = 114.5 - 145 = -\$30.5$ million $\Rightarrow$ $\Delta Profits = -30.5 \cdot 5\% = -\$1.525$ million.

As you can see, an increase in the interest rate always leads to a fall in profits, but the impact is larger the less loans the bank has give out relative to its deposits. The result would be exactly the opposite if interest rates were to fall instead of rise.

Finally, to calculate the change in bank's net worth, note that the change percentage change in the bank's assets and liabilities is the same at all stages:

$$\Delta\% Assets = (-\Delta i) \times DUR = -5\% \times 3 = -15\%,$$
$$\Delta\% Liabilities = (-\Delta i) \times DUR = -5\% \times 2 = -10\%.$$

Then, the change in bank's net worth can be calculated as follows (liabilities equal total assets minus bank capital):

(i) $Assets = 174$, $Liabilities = 164$, $\Delta Net\ Worth = 174 \cdot (-15\%) - 164 \cdot (-10\%) = -\$9.7$ million.

(ii) $Assets = 170$, $Liabilities = 160$, $\Delta Net\ Worth = 170 \cdot (-15\%) - 160 \cdot (-10\%) = -\$9.5$ million.

(iii) $Assets = 175$, $Liabilities = 165$, $\Delta Net\ Worth = 175 \cdot (-15\%) - 165 \cdot (-10\%) = -\$9.75$ million.

(iv) since neither total assets nor liabilities change, $\Delta Net\ Worth = -\$9.75$ million.